

REMARKS AND ARGUMENTS

Claims 1-14 are pending.

Claims 13-14 have been added.

Claims 2-7, 9, and 11 have been withdrawn.

Support for the amendments is found in the claims and specification (e.g., ¶ [0017]), as originally filed.

No new matter is believed to have been added.

Claims 1, 8, and 10 are rejected under 35 U.S.C. 102(b) over Tatsumisago et al., Solid State Ions, 154-155:3-8 (2002). The rejection is traversed because Tatsumisago et al. do not describe or suggest (a) crystallized glass having eight diffraction peaks including peaks at $2\theta = 21.8 \pm 0.3$ deg and 23.8 ± 0.3 deg and (b) the composition of claims 13-14.

(1) The claimed crystallized glass

The claimed glass is a crystallized glass obtained by sintering a sulfide-based glass having a specific composition (Li_2S : 68 to 74 mol% and P_2S_5 : 26 to 32 mol%) at a certain temperature (150 to 360°C), which has eight characteristic diffraction peaks, as in claim 1. The crystallized glass exhibits an extremely high ionic conductivity (see Table 1 of the present specification).

(2) The disclosure of Tatsumisago et al. compared to the claimed crystallized glass.

The attached with this response enlarged Fig. 6 of Tatsumisago et al. (attachment 3) clearly shows that the Tatsumisago et al. crystallized glass does not have diffraction peaks at $2\theta = 21.8 \pm 0.3$ deg and 23.8 ± 0.3 deg compared to the claimed crystallized glass having eight diffraction peaks including the peaks at $2\theta = 21.8 \pm 0.3$ deg and 23.8 ± 0.3 deg, as shown in the enclosed enlarged Fig. 2 of the present specification (attachment 4).

Therefore, the claimed crystallized glass is different from the glass shown in Fig. 6 of Tatsumisago et al. This difference is because the crystallized glass of Fig. 6 of Tatsumisago et al. has a composition of Li_2S : 80 mol% and P_2S_5 : 20 mol%, as shown in the bottom note of Fig. 6, which is different from the composition of claims 13-14.

Table 1 of the present specification shows that desired crystallized glass cannot be obtained when the components of the glass composition are not within the claimed specific range (see ¶ [0017] and claims 13-14).

Thus, Tatsumisago et al. do not anticipate the claimed crystallized glass.

(3) Tatsumisago et al. do not make the claimed crystallized glass obvious.

Although Tatsumisago et al. describe glass having Li_2S : 80 mol% and P_2S_5 : 20 mol%, the claimed crystallized glass is not obvious in view of this disclosure.

For an electrolytes (glass) for lithium ion batteries, the more Li ion the electrolyte contains, the higher the ion conductivity thereof becomes (see page 478, lines 3 to 9 of the right column of attachment 1, A. Hayashi, and M. Tatsumisago, "A High Lithium Ion Conductivity Of Sulfide-based Glass Ceramic Solid Electrolytes", Metal, 2005, vol. 75, No. 4, p.351-354, submitted herewith).

The same dependency applies to a sulfide-based solid electrolyte (glass). As shown in Fig. 4 of attachment 1, when an electrolyte is produced by using the same materials, the ion conductivity thereof becomes the highest when Li_2S : P_2S_5 = 75 mol% : 25 mol%, the secondly highest when Li_2S : P_2S_5 = 80 mol% : 20 mol% and the thirdly highest when Li_2S : P_2S_5 = 70 mol% : 30 mol%. The reason why the sulfide-based glass of a composition of Li_2S : P_2S_5 = 75 mol% : 25 mol% is higher in ion conductivity than the sulfide glass of a composition of Li_2S : P_2S_5 = 80 mol% : 20 mol% is because of the unreacted Li_2S presents in the latter. The reason why the sulfide glass of a composition of Li_2S : P_2S_5 = 85 mol% : 15 mol% is low in ion conductivity is because a lot of Li_2S remains in the composition.

The reason why the ion conductivities of the sulfide glass having a composition of $\text{Li}_2\text{S} : \text{P}_2\text{S}_5 = 80 \text{ mol\%} : 20 \text{ mol\%}$ and the one having a composition of $\text{Li}_2\text{S} : \text{P}_2\text{S}_5 = 75 \text{ mol\%} : 25 \text{ mol\%}$ are almost the same is that the former has more lithium ions than the latter although the former contains remaining Li_2S .

Thus, glass ceramics are not always high in ion conductivity when the content of lithium ion is high. However, in this technical field, at the time of the invention, it was believed that when a sulfide-based solid electrolyte (glass) is heated, not all glass is crystallized but only at most 50% of the glass.

For this reason, in order to improve ion conductivity, a person skilled in the art would have tried to heat glass having a composition from $\text{Li}_2\text{S} : \text{P}_2\text{S}_5 = 75 \text{ mol\%} : 25 \text{ mol\%}$ to $80 \text{ mol\%} : 20 \text{ mol\%}$, particularly, a composition near $80 \text{ mol\%} : 20 \text{ mol\%}$ for crystallization, but would not have tried to heat glass having the composition having the claimed composition $\text{Li}_2\text{S} : 68 \text{ to } 74 \text{ mol\%}$ and $\text{P}_2\text{S}_5 : 26 \text{ to } 32 \text{ mol\%}$ to improve the ion conductivity thereof.

Thus, Tatsumisago et al. do not make the claimed glass obvious.

In addition, Fig. 1 of the attachment 2 (A. Hayashi, and M. Tatsumisago, "A High Lithium Ion Conductivity Of Sulfide-based Glass Ceramic Solid Electrolytes", Metal, 2005, vol. 75, No. 4, p.351-354, published after the filing of the present application, submitted herewith) shows that the more Li_2S is used as the material of glass ceramics (up to $80 \text{ mol\%} : 20 \text{ mol\%}$), the higher the ion conductivity becomes.

Thus, the ion conductivity provided by the claimed glass would not have been reasonably expected from the claimed material composition and crystallization based on the disclosure of the cited references and knowledge in the field of crystallized glass at the time of the present invention. Thus, it would not have been reasonable to expect, based on the disclosure of Tatsumisago et al., that the crystallized glass having the claimed composition

would have had high ion conductivity. Thus, the claimed crystallized glass provides an unexpected result.

Thus, Tatsumisago et al. do not anticipate or make the claimed crystallized glass obvious.

Respectfully submitted,

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